



ELIMINATION OF TEMPERATURE AND DENSITY DIFFERENTIALS: THE CYCLIC DENSITY SPECIFICATION

Since 1995, WSDOT has performed research on temperature and density differentials in Hot-Mix Asphalt (HMA) pavements. Temperature differentials are formed during transport of the HMA to the paving project. As the mix is transported, a crust develops on the HMA surface, which, if not remixed with the hotter, underlying mass of HMA prior to placement, becomes concentrated in relatively small areas in the mat (Figure 1). These areas are near cessation temperature and tend to resist adequate compaction.

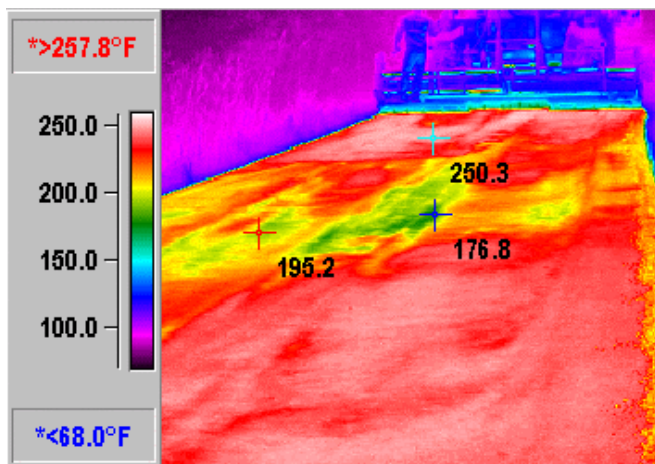


Figure 1. Temperature differential in HMA mat.

The result is a mat with a cyclic pattern of small low-density, open-textured areas that tend to deteriorate more quickly than the rest of the pavement (Figure 2). Although these areas can be small, they can significantly shorten the life of the pavement.

This research has led to the implementation of a cyclic density specification that has been in use on specified WSDOT projects since 2002. This specification purposely targets temperature differentials in a cyclic pattern in an attempt to identify their occurrence and eliminate them during construction.

The testing program uses temperature differentials as an initial indicator of potential low-density areas and proceeds in three basic steps:

- An infrared camera or infrared temperature gun is used to locate temperature differentials.
- If the temperature differential between a particular location and the surrounding mat is 25°F or greater, nuclear density testing is performed at the cool spot's location.
- If densities are verified as unacceptably low and there is a minimum of four locations per density lot, a penalty of 15 percent of the HMA unit price is assessed.

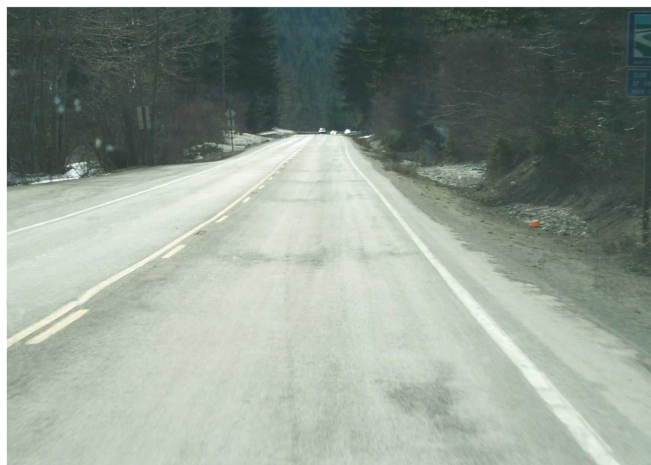


Figure 2. Cyclic pattern of low-density, permeable areas.

On projects where this specification has been used, the occurrence of temperature differentials and their resulting density differentials has been dramatically reduced. For instance, the specification was used on 13 projects in 2003. Of these projects, 12 utilized a material transfer vehicle (MTV) from the start of the project and had temperature differentials in the 8 to 15°F range. The one project that did not utilize a MTV at the start of the project failed the cyclic density specification during the first two days of paving. A MTV was placed in the paving train and temperature differentials and visible segregation were drastically reduced.

The goal is to implement the specification statewide.

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